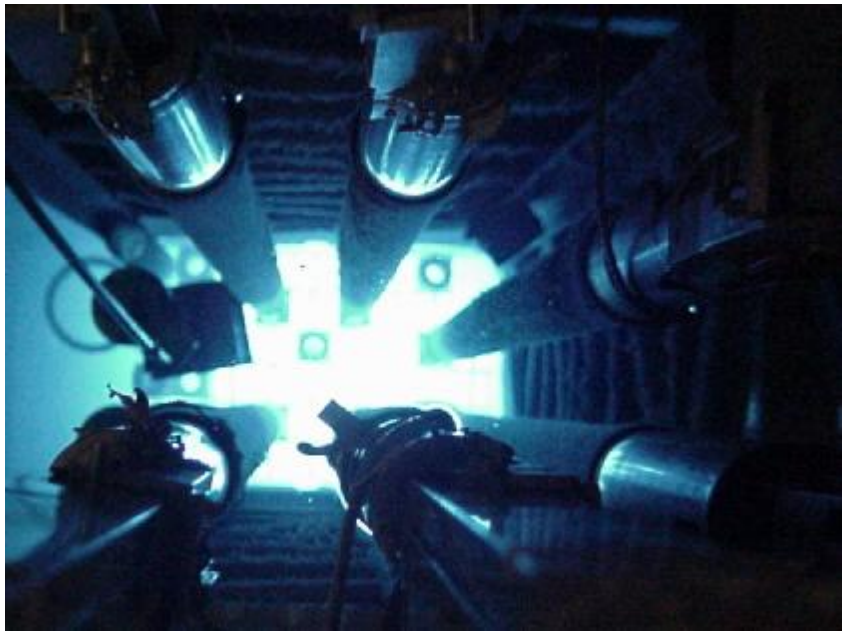
Slovak Nuclear Forum
Slovak Nuclear Society
European Nuclear Society
European Atomic Forum

International Conference on

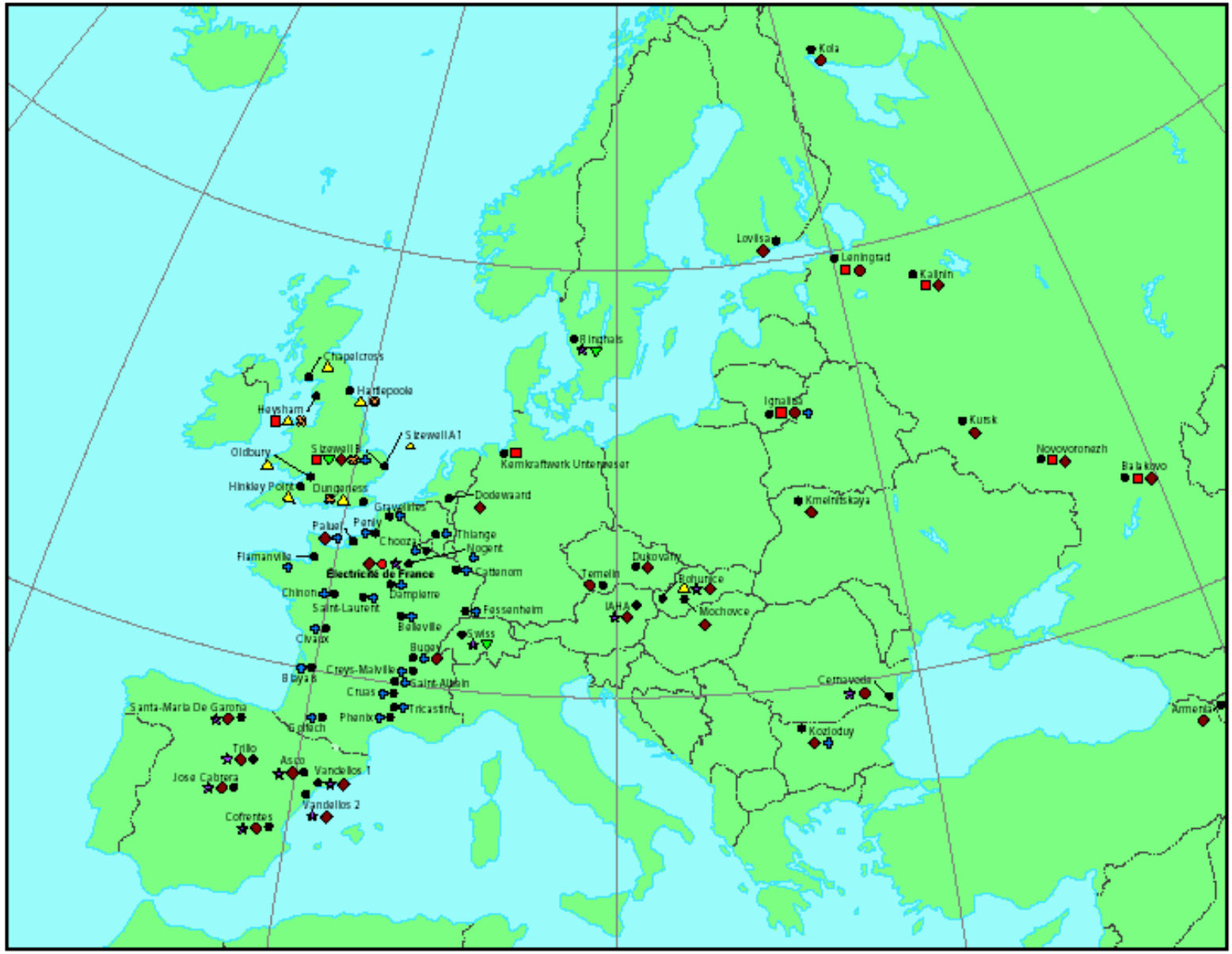
Go Nuke Slovakia!



Data Systems & Solutions
July 2003

Data Systems & Solutions

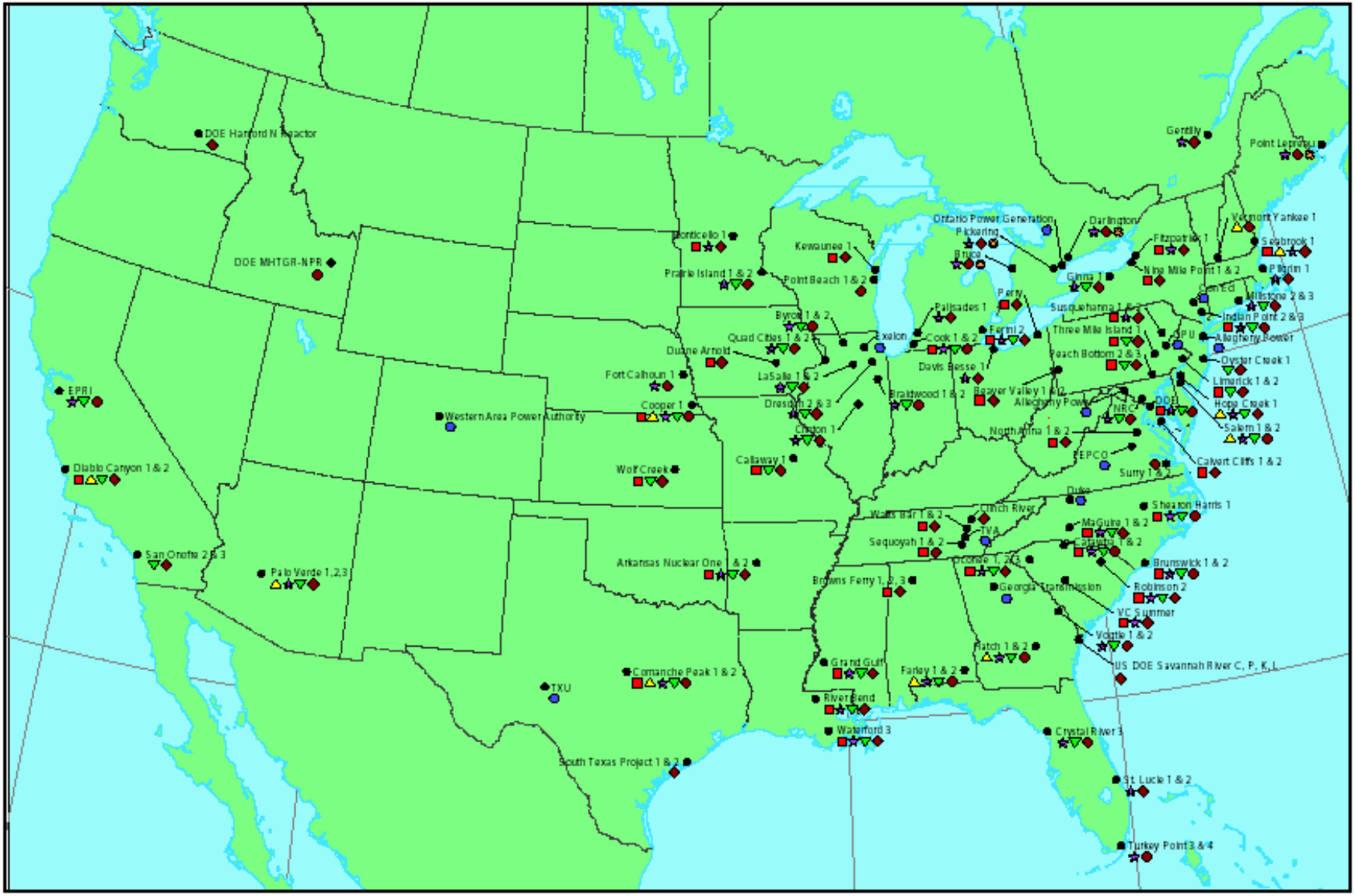
European Utility Client References



Plant Computers | Simulators | Risk Monitors | Automation Software | Engineering Services | Turbine Island Products | I&C Products

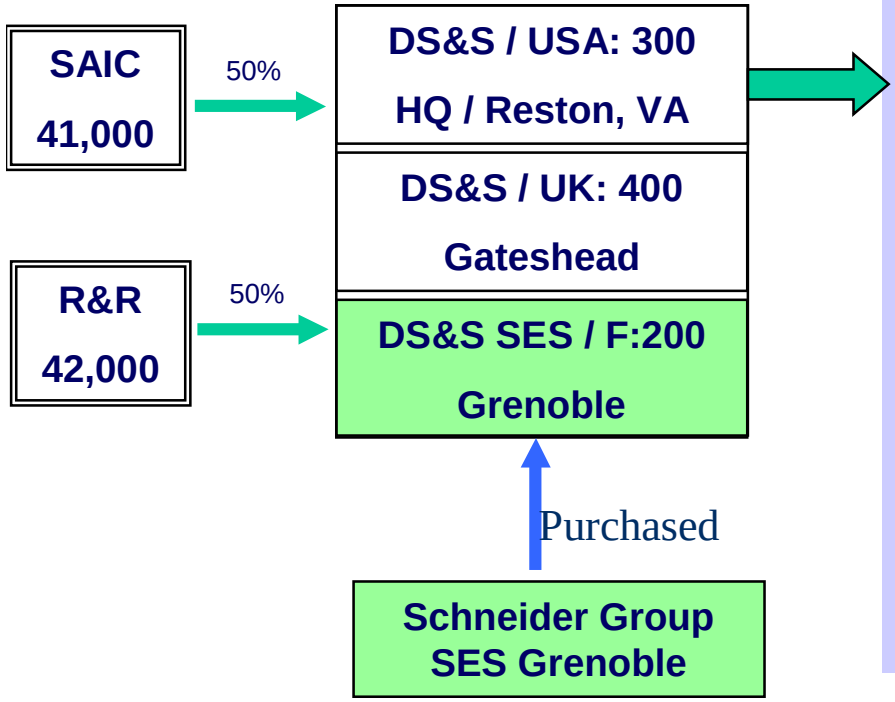
Data Systems & Solutions

North American Utility Client References



Plant Computers | Simulators | Risk Monitors | Automation Software | Engineering Services | Turbine Island Products | Predictive Maintenance

DS&S Historical Overview



I&C:	25+ digital RPS's, 80+ NPP's I&C products (e.g. SPINLINE-3 I&C)
	35+ turbine/generator controls
	85+ Plant Information Computers, Software, Simulators BWR / PWR / VVER / AGR / MAGNOX / RBMK
IT Services:	Data Base Integration --- PERFORMA
	Automation Tools --- CORA "Paperless NPP"
Risk Analysis:	Off-line & On-line Risk Management Systems--- EOOS
Asset Management:	Nuclear Asset Management --- integrated concept
Engineering:	Services, Support, Analyses

Nuclear

©2003 Data Systems & Solutions – All Rights Reserved

ESG Products & Services (1)

- There are five prime product and service areas
  - **Nuclear Engineering Projects** : control and monitoring systems, real-time plant process computers, major nuclear I&C engineered upgrades (Ignalina, PPCs, Turbine Governors, AVRs Excitation)
    - 100 employees, operations in Gateshead, UK, and Huntsville, Alabama;
  - **Simulation and Analysis**: training simulators and engineering modeling tools for nuclear and fossil plants (SIMPORT,RELAP5, CAFTA, RBDA)
    - 35 employees; based in Frederick, Maryland;
  - **DS&S, France (SES)** : nuclear instrumentation and control, reactor protection for nuclear power stations (PWR, BWR,VVER, RBMK, Research, Naval PWR's)
    - 200 employees, offices, training and manufacturing in Meylan and Poisat, Grenoble, France;
  - **Engineering Consulting Services:** consulting services and software for risk management and operational efficiency (CORA, MMW, PERFORMA, EOOS, R&R Workstation, Nuclear Asset Management)
    - 35 employees, offices in Los Altos, California; Houston, Texas and Prague, Czech Republic;
  - **Nuclear Asset Management**: all offices; adapting the products and technology to provide wholisitic risk-informed decision making.

©2003 Data Systems & Solutions – All Rights Reserved

Sizewell B Nuclear Power Station: Instrumentation and Control Contracts

- Design
- Process plant control & instrumentation
- Primary protection system
- Secondary protection system – nucleonic
- Nuclear sampling
- Reactor building fans C&I
- Load shedding control
- Turbo-generator C&I
- Mechanical installations
  - Pipework
  - Racks and panels
  - Pumping systems

©2003 Data Systems & Solutions – All Rights Reserved

Torness Nuclear Power Station: Instrumentation & Control Contracts

- Design
- Main control room and EIC desks & panels
- Flux measurement systems
- Reactor coolant C&I
- Post trip sequence systems (X & Y train)
- Essential plant protection equipment
- Fuel route
- Reactor analysis system
- Turbine island
- Seismic monitoring

©2003 Data Systems & Solutions – All Rights Reserved

DS&S France (Schneider Electric)

- **Delivery of Reactor Protection Systems for NPPs in France (EdF)**
- **Installation of Spinline in many countries including Lithuania, Brazil, Belgium, China, etc.**
- **Complete replacement of Nuclear Instrumentation and Control System for Dukovanny NPP, Czech Republic**

©2003 Data Systems & Solutions – All Rights Reserved

List Of Projects For Russian Designed Reactors

PROJECT	COUNTRY	FUNDING
PPC Replacement:		
Ignalina NPP Unit 1	Lithuania	EXIM bank
Ignalina NPP Unit 2	Lithuania	EXIM bank
Armenia NPP	Armenia	DOE
Kalinin NPP UNIT 2	Russia	TACIS
Balakovo Units 1&2	Russia	TACIS
Development of Strategy For PPC Replacement	Lithuania	EBRD

©2003 Data Systems & Solutions – All Rights Reserved

List Of Projects

PROJECT	COUNTRY	FUNDING
SPDS:		
Novovoronezh NPP Unit 3	Russia	DOE
Novovoronezh NPP Unit 4	Russia	DOE
Novovoronezh NPP Unit 5	Russia	DOE
Ignailina NPP Unit 2	Lithuania	DOE
Armenian NPP	Armenia	DOE
Kalinin NPP Unit 2	Russia	TACIS
Balakovo Unit 1, 2	Russia	TACIS

©2003 Data Systems & Solutions – All Rights Reserved

List Of Projects

PROJECT	COUNTRY	FUNDING
Reactor Protection System		
Novovoronezh NPP Unit 5	Russia	EU
Ignalina NPP Unit 2	Lithuania	EU
Armenian NPP(detectors)	Armenia	EU
Reactor Related I&C Replacement		
Dukovanny NPP	Czech	CEZ
Verification & Validation		
I&C	Temelin	CEZ

©2003 Data Systems & Solutions – All Rights Reserved

List Of Projects

PROJECT	COUNTRY	FUNDING
Rad Monitoring System		
Ignalina NPP external	Lithuania	EBRD
Ignalina NPP internal	Lithuania	NPP
Environmental Monitoring		
System	Kazakhstan	WorldBank

©2003 Data Systems & Solutions – All Rights Reserved

List Of Projects

In-Depth Safety Analysis

PROJECT	COUNTRY	FUNDING
Kola NPP	Russia	DOE
Novovoronezh NPP	Russia	DOE
Kursk NPP	Russia	DOE
Khmelnitsk NPP	Ukraine	DOE

Several NPP Projects
under INSP Program:
e.g. reliability databases,
symptom oriented
instructions — Russia, Ukraine — DOE

©2003 Data Systems & Solutions – All Rights Reserved

List Of Projects For FSU

Crisis Centers

PROJECT	COUNTRY	FUNDING
Crisis Center for Regulatory Body	Ukraine	DOE
Crisis Center for Regulatory Body	Russia	DOE

©2003 Data Systems & Solutions – All Rights Reserved

List Of Projects For Czech Republic

PROJECT	NPP	CUSTOMER
Safety Analysis, Level 2 PSA	Dukovany	BNL, DOE
Risk-Based Tech. Specs.	Dukovany	SUJB
Safety Analysis, Level 1 PRA	Dukovany	IAEA, DOE
I&C replacement	Dukovany	CEZ

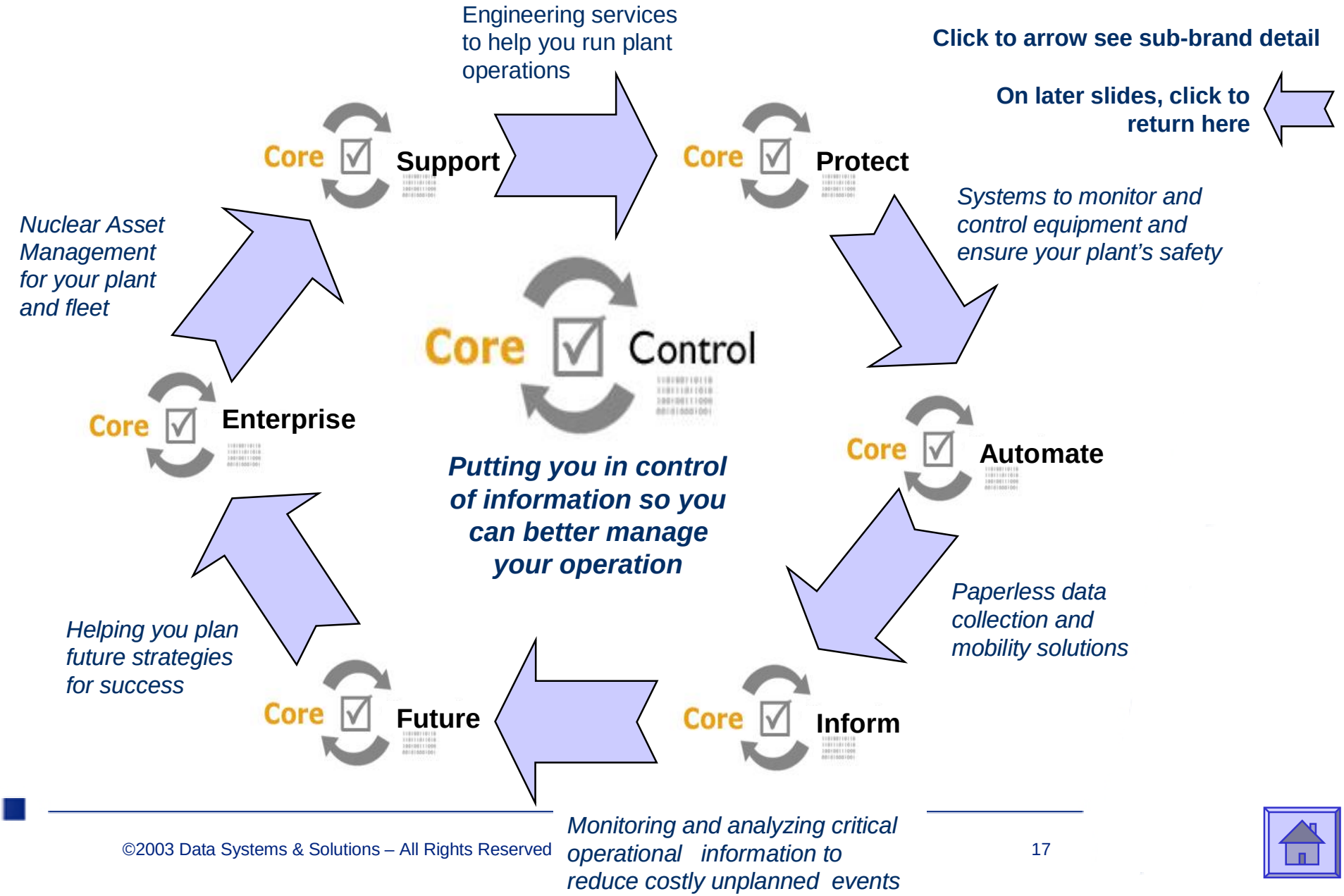
©2003 Data Systems & Solutions – All Rights Reserved

List Of Projects For Slovakia

PROJECT	NPP	CUSTOMER
Risk and Reliability Workstation	UJD	PNL, DOE
Risk Monitoring	Bohounice	SE
Safety Analysis Level 1, PRA	Mochovce	SE,VUJE
Simulator Upgrade with VUJE	Slovakia	DOE

©2003 Data Systems & Solutions – All Rights Reserved

ESG Products & Services



©2003 Data Systems & Solutions – All Rights Reserved

Data Systems & Solutions

Core Protect

Systems to monitor and control equipment and ensure your plant's safety

©2003 Data Systems & Solutions – All Rights Reserved

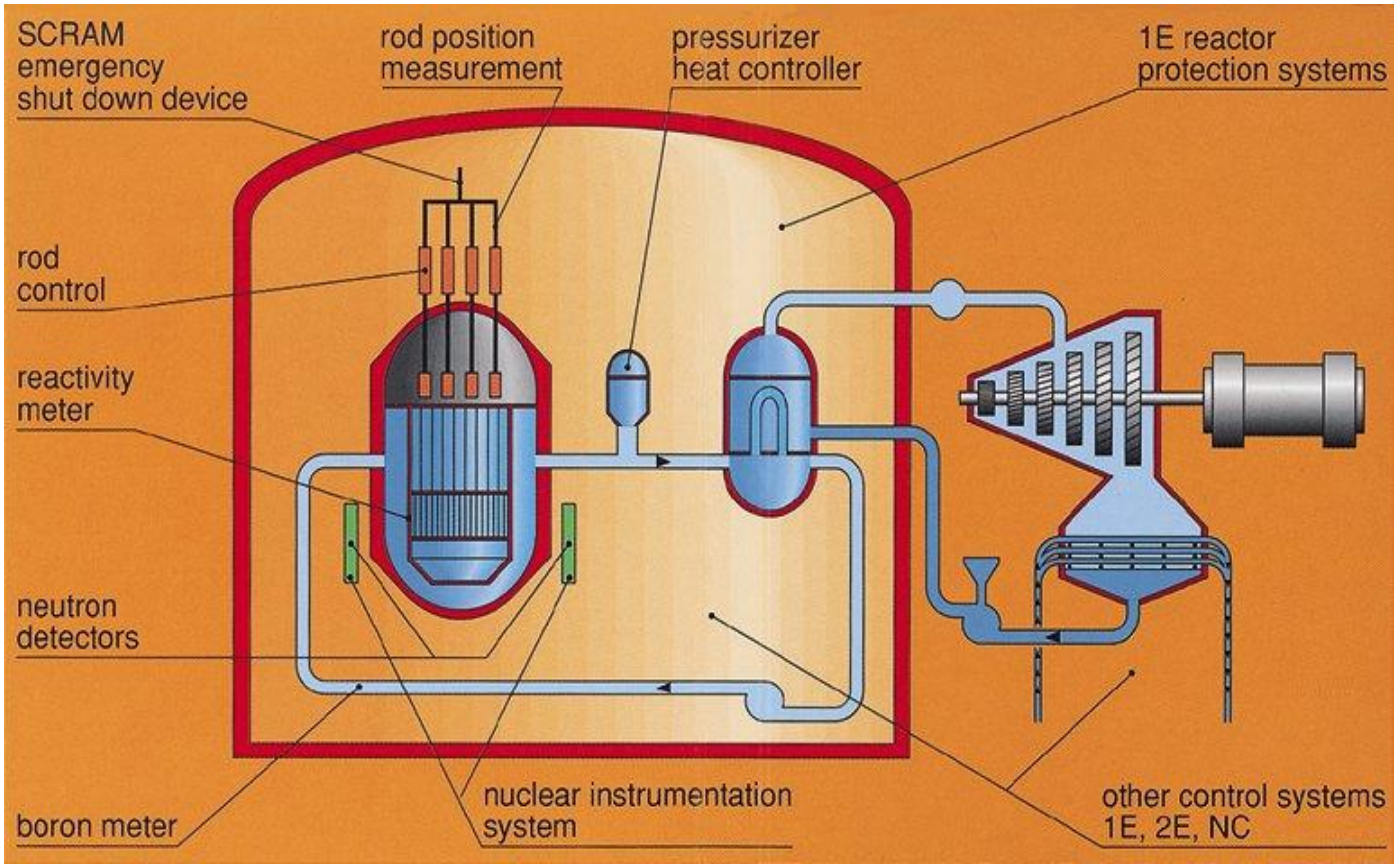
Products & Services

- Digital Instrumentation & Controls Systems
  - SPINLINE3-Reactor Protection, Rod Control, Secondary Shutdown Systems
  - Neutrol Flux Detectors, Boron & Reactivity Meters & other SES products
- Turbine/Generator Controls
  - Automatic Voltage Regulators (AVRs)
  - Electrohydraulic Governors (EHGs)
  - Excitation Systems
  - Programmable Logic Controllers
- Plant Computers, Rad Monitoring, Rod Position Indication, etc
- Simulators and Safety Analysis
- Plant Automation and Risk Management Systems
- Security Products

©2003 Data Systems & Solutions – All Rights Reserved

Product Summary – SE Systems & Equipment

- N4 NPP safety systems (1E), safety related systems:



- Large installed base in France
- International references include:
  - Dukovany – in progress
  - Ignalina Unit 2 DSS
  - Novovoronesh RPS-in progress
  - Koeberg 1 & 2 (So. Africa),
  - Uljin 1 & 2 (Korea),
  - Doel 1-4,
  - Tihange 1-3 (Belgium),
  - Daya Bay 1 & 2, Ling Ao 1&2, Qinshan I&II (China),
  - Kozloduy 3 & 4 (Bulgaria),
  - Medzamor (Armenia)

©2003 Data Systems & Solutions – All Rights Reserved

SPINLINE 3 unique experience

Data Systems & Solutions

EDF NPPs safety I&C systems in France

1970
900 MW

- analogue
- relaying

CP0-1-2

1980
1300 MW

- 8 bits Motorola microprocessors
- point-to-point links
- assembler

P4

1990
1450 MW

- 16 bits Motorola µP
- NERVIA networks
- SAGA SDE

N4

2003

KOZLODUY
FESSENHEIM
BUGEY
QINSHAN
TIHANGE
DUKOVANY
IGNALINA
Novovoronesh

- 32 bits Motorola µP
- NERVIA networks
- CLARISSE SSDE

SPINLINE 3

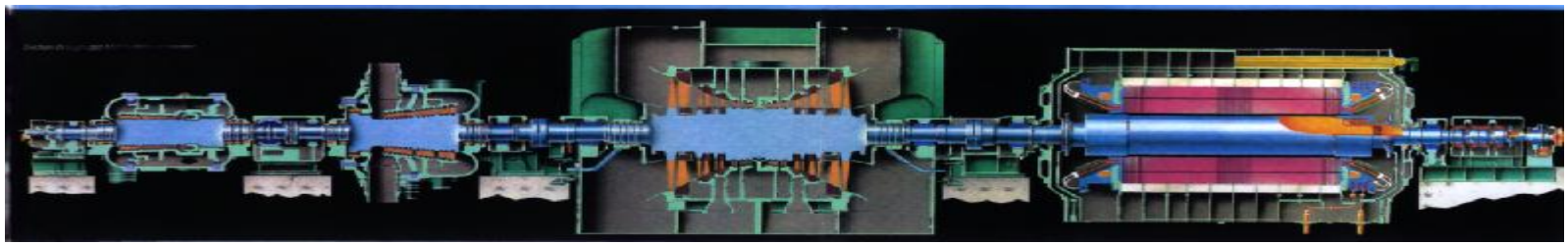
©2003 Data Systems & Solutions – All Rights Reserved

Product Summary – TG Island Products

- Complete tool kit of capabilities to control, protect and monitor the health of the turbine and generator

  - Automatic Voltage Regulators (AVR)/Excitation Systems
  - Electro-Hydraulic Governors (EHG)
  - Electronic Overspeed Trips (EOST)
  - Generator Core Condition Monitors (GCCM)

Electronic over speed trip



Electro-hydraulic governor

Turbine supervisory equipment

Excitation systems

©2003 Data Systems & Solutions – All Rights Reserved

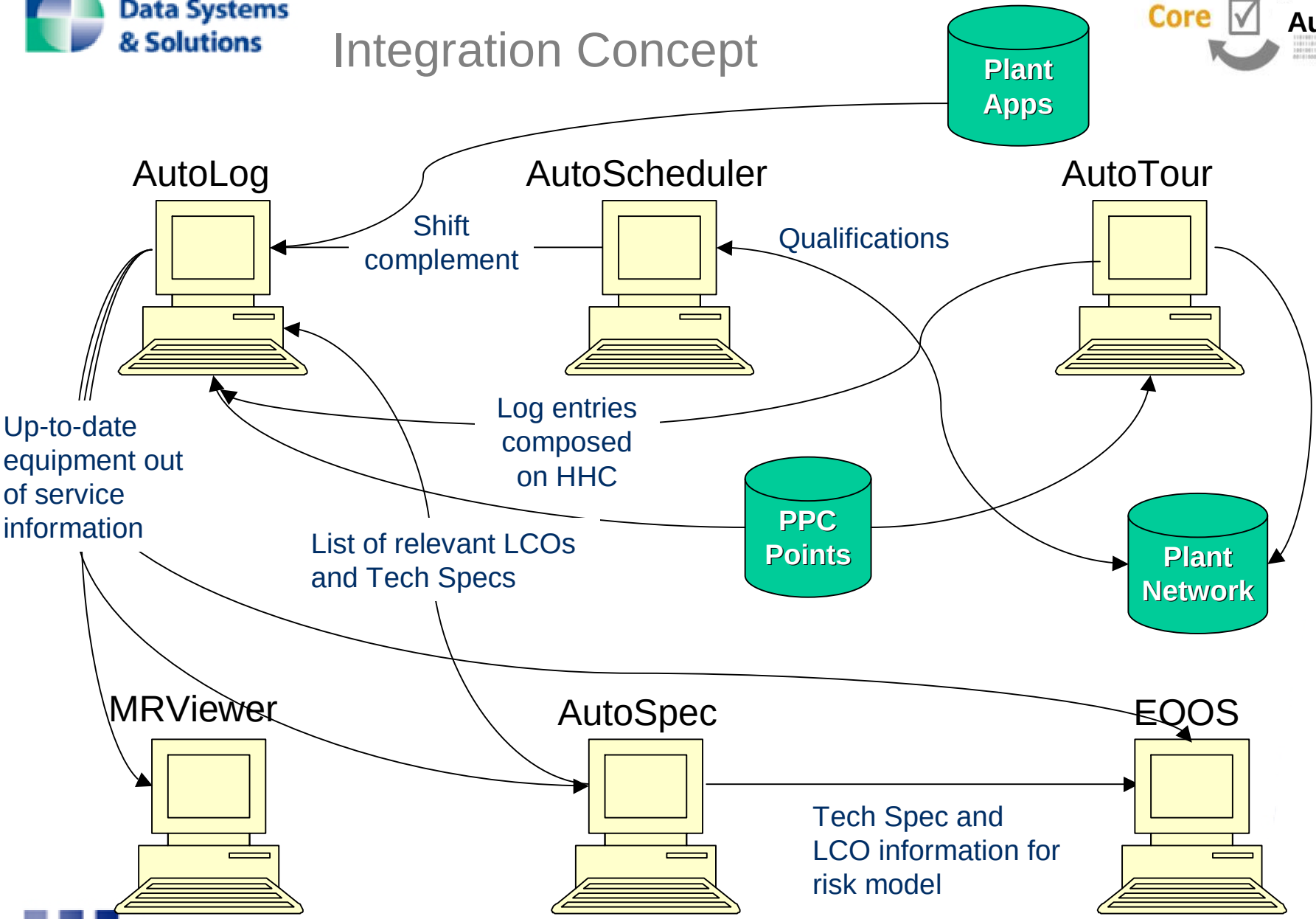
Data Systems & Solutions

Core Automate

Paperless data collection and mobility solutions

©2003 Data Systems & Solutions – All Rights Reserved

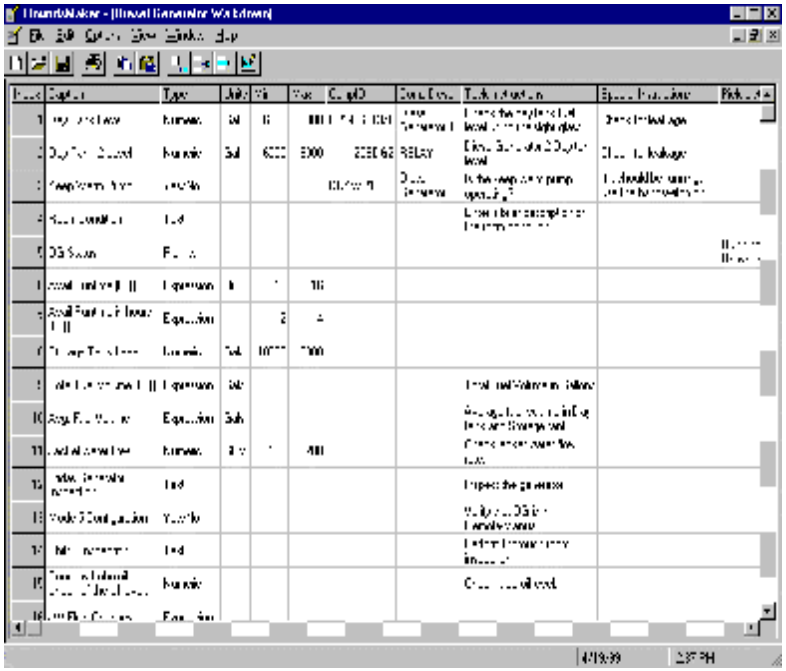
Integration Concept



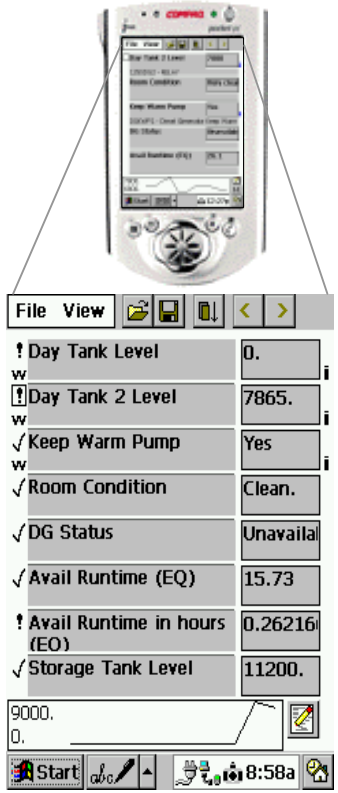
©2003 Data Systems & Solutions – All Rights Reserved

Product Summary - AutoTour

- RoundsMaker
  - prepare field action lists, e.g., rounds
- AutoTour Host
  - store, review and approve and evaluate field collected data
  - data trending tool



- AutoTour on the HHC
  - execute field action lists, e.g., rounds, work orders



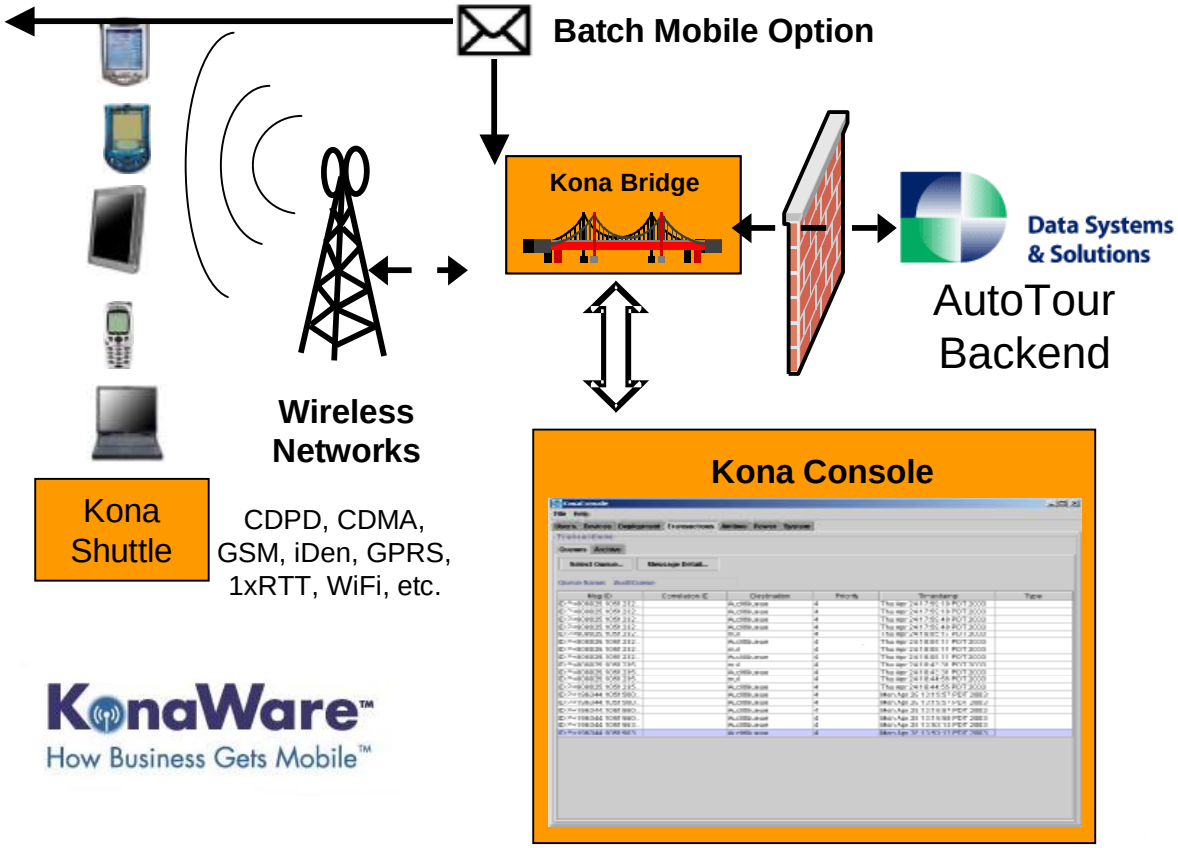
©2003 Data Systems & Solutions – All Rights Reserved

Data Systems & Solutions

AutoTour Wireless Field Mobility Solution

Core Automate

AutoTour Application



KonaWare™
How Business Gets Mobile™

- § Transactional Reliability
- § Security
- § Central Administration & Management
- § Seamless Enterprise Integration
- § Monitoring and Auditing Data
- § Persistent User Experience

©2003 Data Systems & Solutions – All Rights Reserved

AutoTour Mobility Applications

- Operator Rounds and System Engineering Walkdowns
  - Collect accurate and timely information about asset condition to make “real time” assessments about component or system health
  - Receive new information associated with work to be performed on assets in round or walkdown
  - Trigger work requests and wirelessly transmit these to effectively schedule preventative and/or corrective maintenance activities (optimization and prioritization)
- Work Order Field Mobility
  - Wireless transmission of work task status enables commencement of dependent activities, as well as optimal scheduling of resources
- Valve Checklists (using AutoAlign)
  - Wirelessly execute nuclear startup procedures
    - Shave 1 to 2 days off outage
- Inventory Management, Warehousing, Goods Request, and Ordering Material
  - Track goods from warehouse to receipt by technician
  - Query and place orders for additional stock items

©2003 Data Systems & Solutions – All Rights Reserved

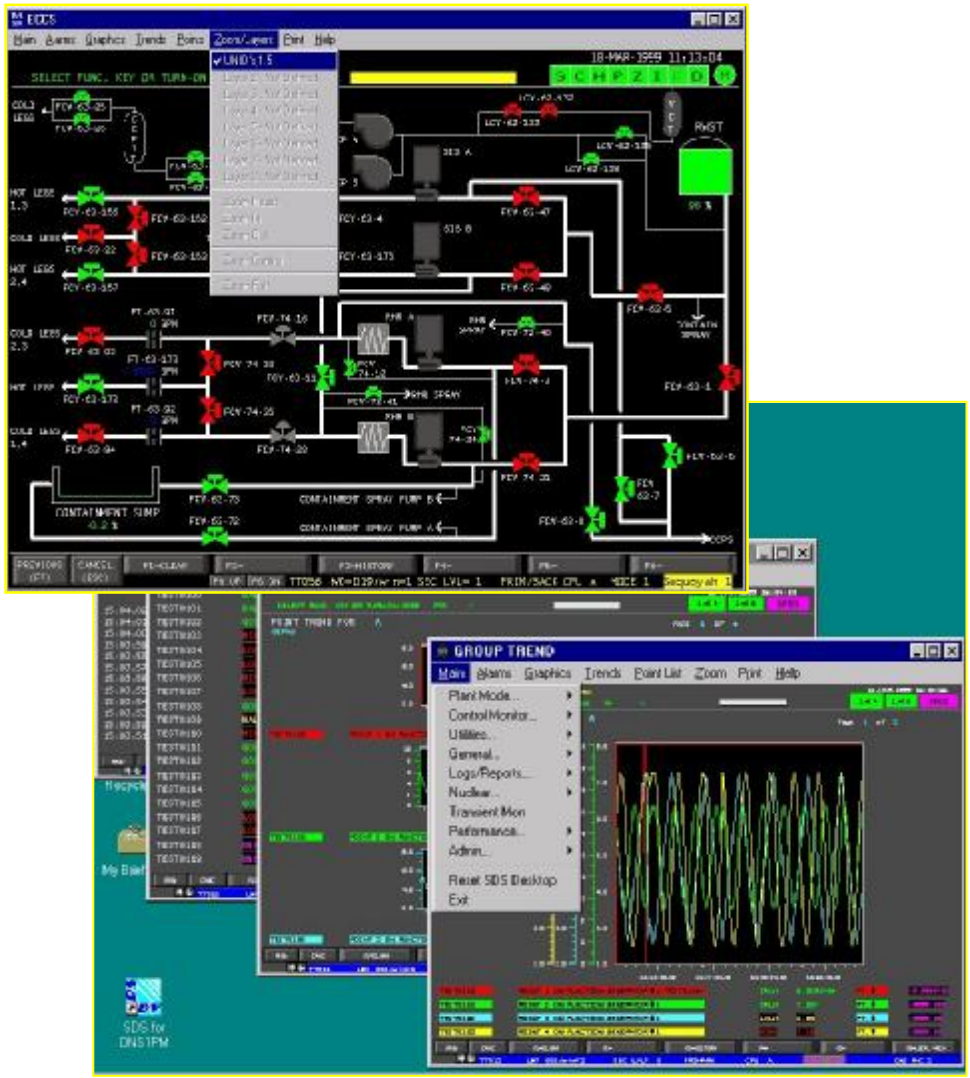
Data Systems & Solutions

Core Inform

Monitoring and analyzing critical operational information to reduce costly unplanned events

©2003 Data Systems & Solutions – All Rights Reserved

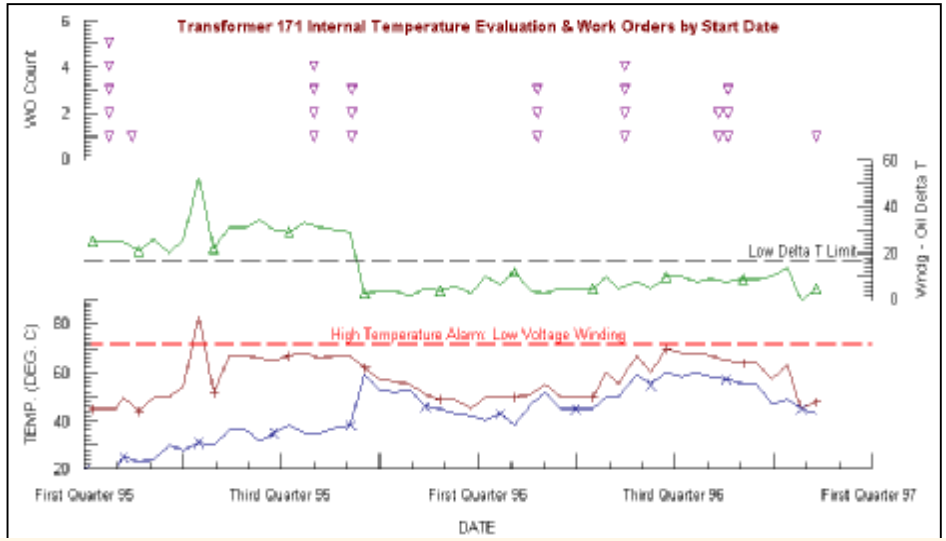
Product Summary: Plant Computers-I



- Full suite of plant monitoring systems and applications
- Modular open system architecture
- Single-train or redundant system to meet customer needs
- Can be linked to enterprise-level information systems
- Includes Process Computer, SPDS, Annunciator, Radiation Monitoring, Rod Position Indicator applications,etc.

©2003 Data Systems & Solutions – All Rights Reserved

Product Summary: Performa



Incident Investigation

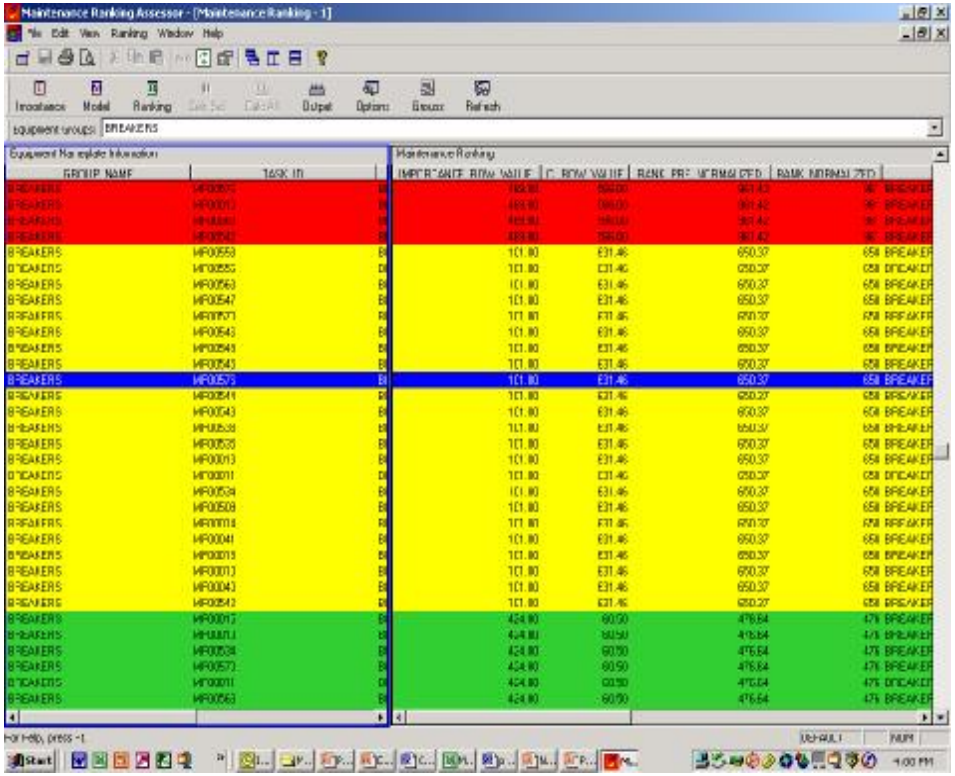
	# of PSM				# of non-PSM				Other				Total			
	Open	Warn	Past Due	Closed	Open	Warn	Past Due	Closed	Open	Warn	Past Due	Closed	Open	Warn	Past Due	Closed
Jan-2003	4	0	0	115	1	0	0	102	6	2	0	15	11	2	0	190
YTD	4	0	0	115	1	0	0	102	6	2	2	15	11	2	2	190
Total	4	0	0	115	1	0	0	102	6	2	2	15	11	2	2	190

	# of Audit				# of PHA				All Past Due
	Open	Warn	Past Due	Closed	Open	Warn	Past Due	Closed	
Jan-2003	37	3	0	17	1	0	0	18	
YTD	37	3	0	17	1	0	0	18	2
Total	37	3	0	17	1	0	0	18	

- Configuration Editor
  - Connects data sources to Performa
- Snapshot Agent
  - Extracts data through the use of automated queries
- Performance Assessment Module
  - Data integration & analysis
- Web Publisher
  - Publishes output to web pages
- Scheduler
  - Schedules run-times for program & issues Email notifications

©2003 Data Systems & Solutions – All Rights Reserved

Product Summary: MMW/MRA

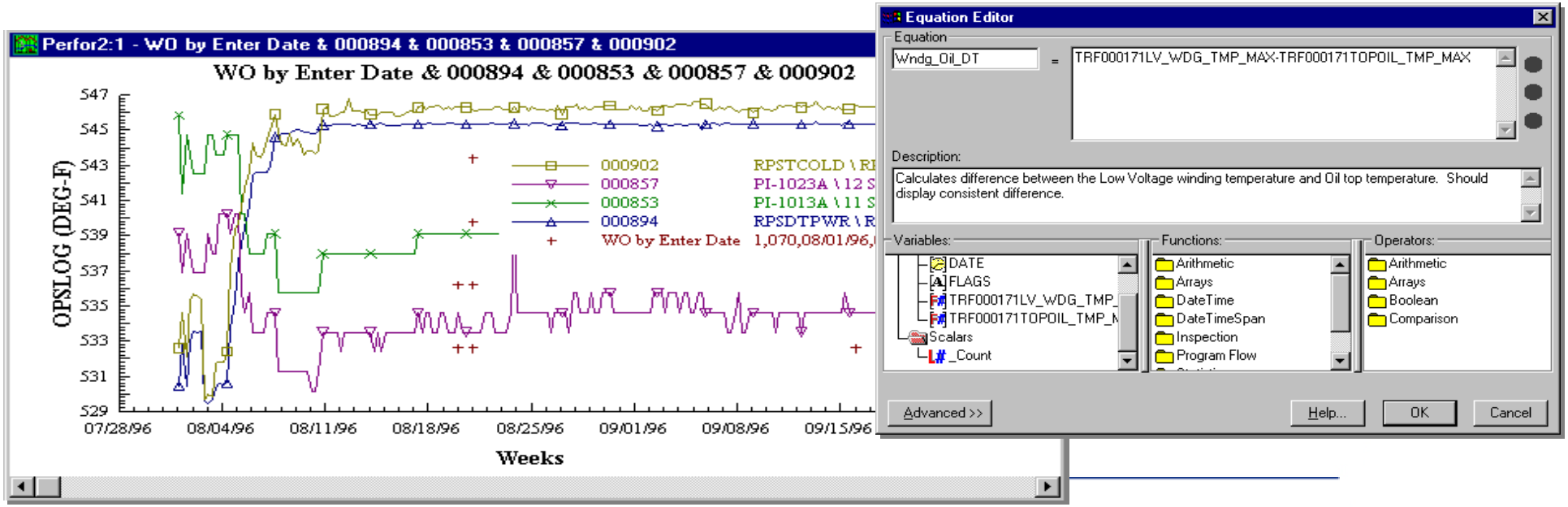


- Importance Module
  - Orders equipment by customer-defined measures of importance
- Condition Indicating (CI) Module
  - Calculates overall equipment condition using wear model algorithms
- Ranking Module
  - Combines importance and condition to produce an overall maintenance ranking

©2003 Data Systems & Solutions – All Rights Reserved

Example Application: Trending of Process Data

- Interfaces with popular **historians** (i.e. OSI's PI, AspenTech IP2.1, DNA, etc.)
- **Equation Editor** to provide full trending capabilities and curve fits
- Set-up **alarms** for notification via the corporate e-mail system
- Data from multiple sources can be **combined** with process data
- Trends can be **automated** through Performa's template function
- **Limit** lines can be added to easily determine out of limit conditions
- Graph **annotations** can be used to document event reconstruction



©2003 Data Systems & Solutions – All Rights Reserved

Data Systems & Solutions

Helping you plan future strategies for success

©2003 Data Systems & Solutions – All Rights Reserved

Products & Services (1)

- **EOOS**
  - **predicts** changes in plant availability and real time evaluation of risk from changing plant configurations

- **Simport**
  - **simulates** plant thermal hydraulic performance with full real time nuclear reactor transient reproduction
  - **provides** real-time executive control, graphical engineering station, Instructor and Operator Station, full set of simulation modeling tools, panel graphics environment and diagram animation features
- **Other simulations and Engineering Analysis**,
  - RELAP5,
  - CAFTA, RBDA, etc

©2003 Data Systems & Solutions – All Rights Reserved

Data Systems & Solutions

Core Enterprise

Nuclear Asset Management for your plant and fleet

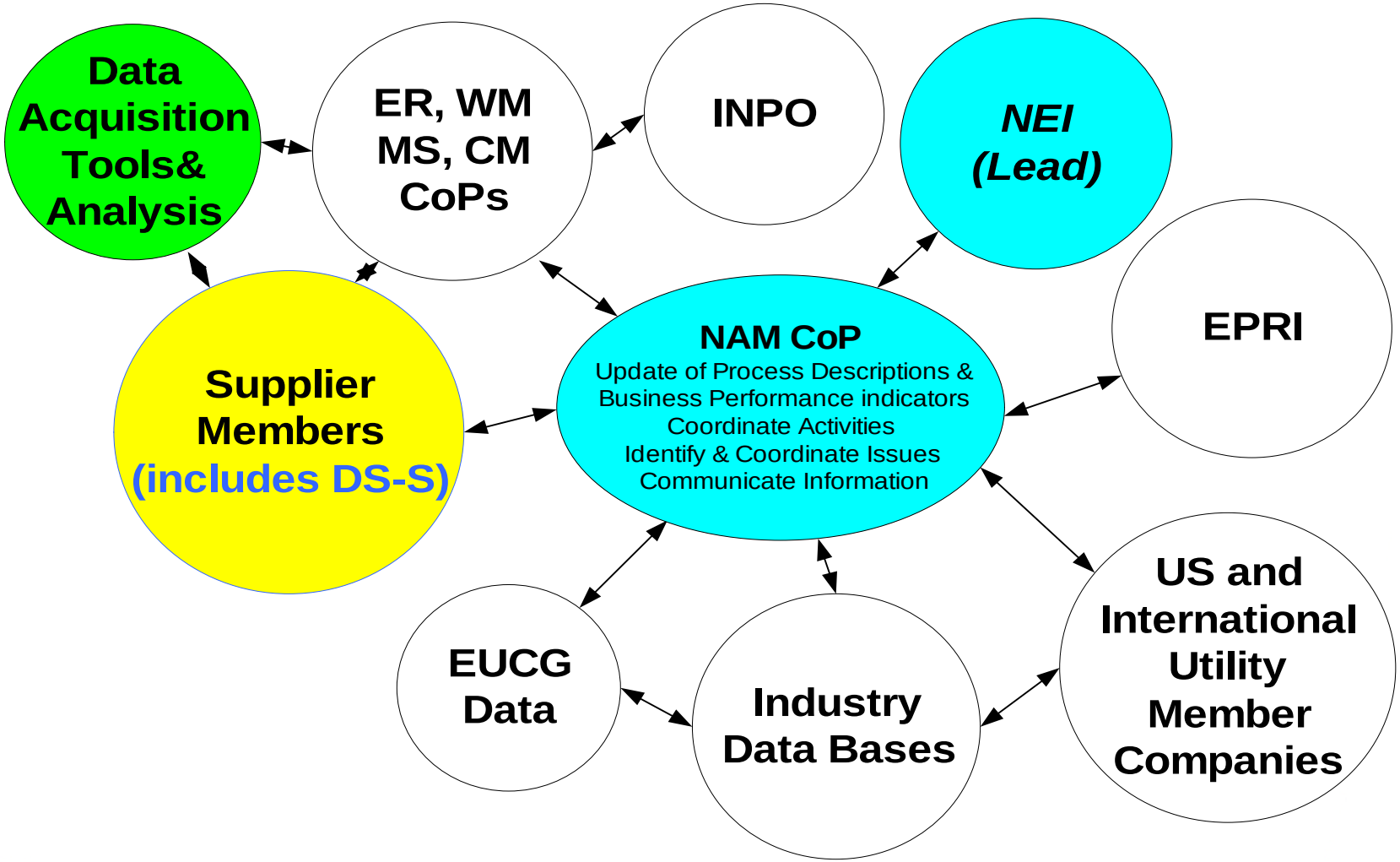
©2003 Data Systems & Solutions – All Rights Reserved

NEI Definition

Process for making resource allocation and risk management decisions at all levels of a nuclear generation business to maximize value / profitability for all stakeholders while maintaining plant safety.

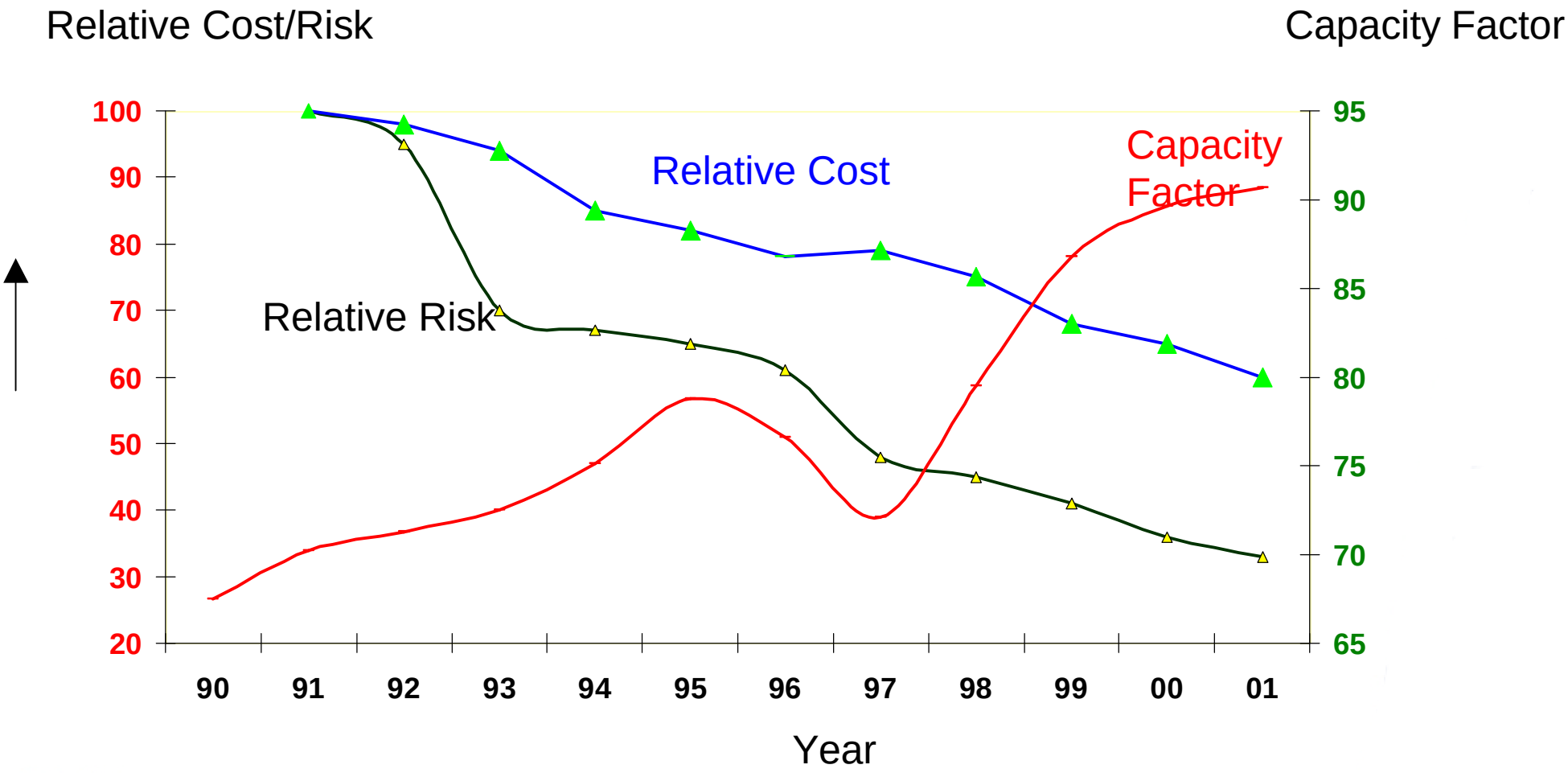
©2008 Data Systems & Solutions – All Rights Reserved

NAM Community of Practice(NEI)



©2003 Data Systems & Solutions – All Rights Reserved

A Nuclear Success Story(source NEI)



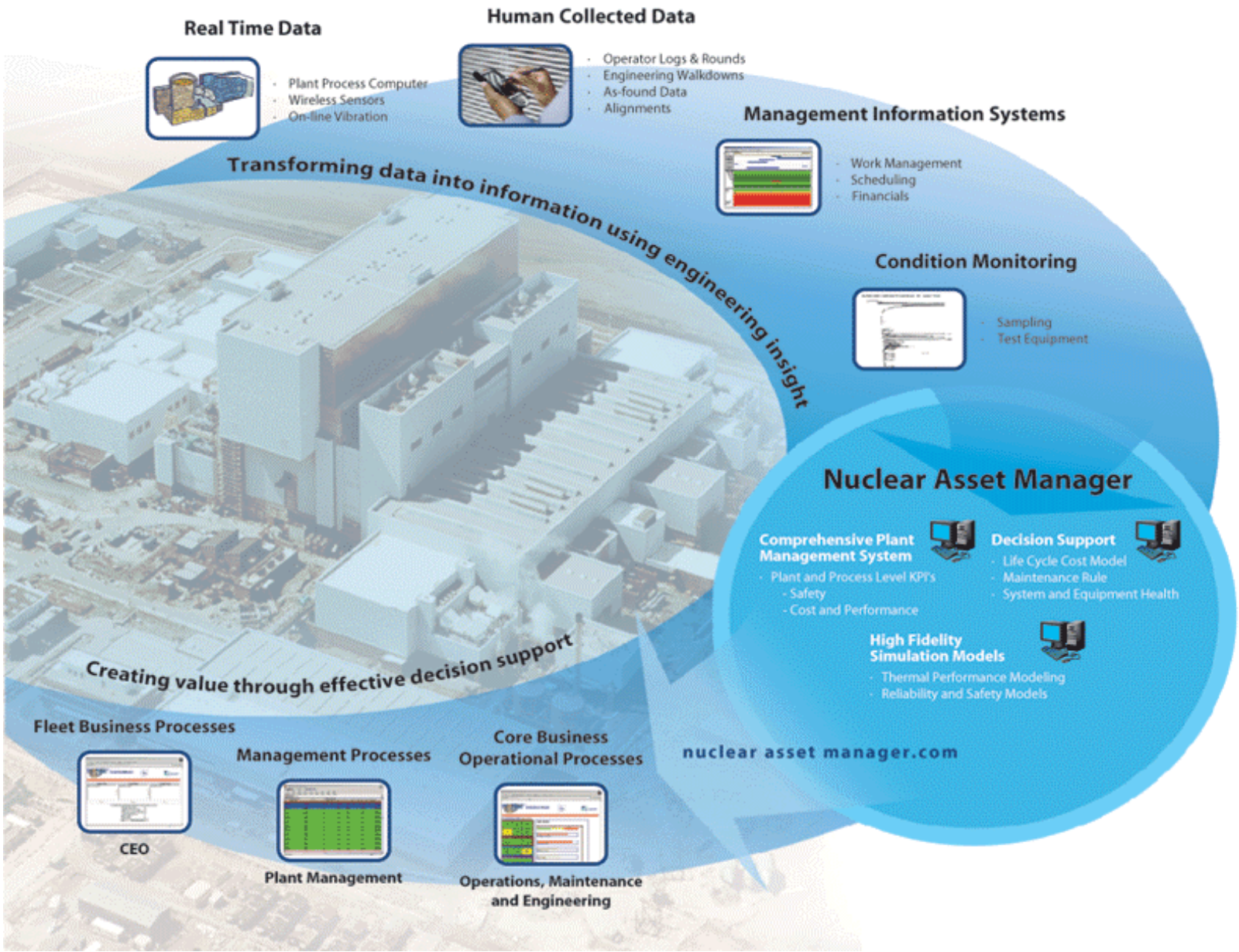
Based on UDI & NUS Data plus info. from ERIN Eng & EPRI

©2003 Data Systems & Solutions – All Rights Reserved

Data Systems & Solutions

Asset Management in Nuclear

Core Enterprise



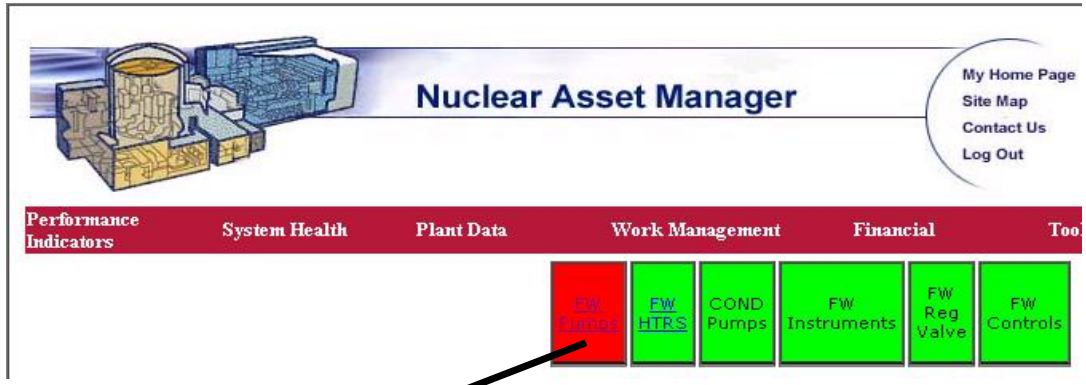
- Understanding plant conditions and fleet impact
- Standardizing performance
- Integrating information from disparate systems
- Predicting plant, system, and component performance
- Making better decisions that support a real strategy

ESG SW Products Enable Operations, Maintenance, and Engineering

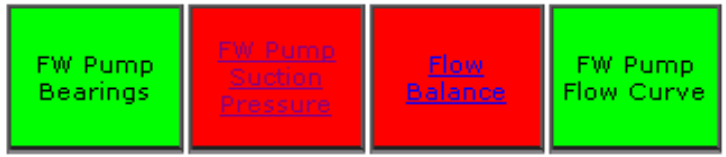
- Engineering
  - System health monitoring, system walkdowns, Maintenance Rule evaluations, equipment reliability assessments, performance monitoring, risk-informed assessments and risk analysis
  - **Performa/MMW, AutoTour, MRViewer, Simulator, R&R software**
- Operations (Control Room)
  - Plant system monitoring, narrative logging, rounds and general inspections, LCO tracking, configuration management, scheduling, “what if” analyses
  - **PMS, AutoLog, AutoTour, AutoSpec, AutoAlign, AutoScheduler, EOOS**
- Maintenance
  - Work close-out, work planning, maintenance effectiveness/maintenance optimization
  - **AutoTour, EOOS, Performa/MMW**
- Training
  - Practicing decision-making in simulated environments
  - **Simulator, EOOS**

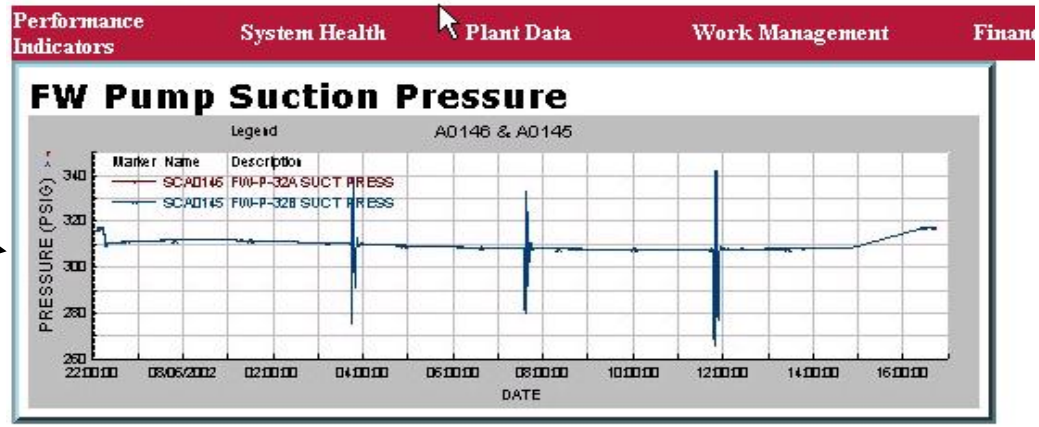
©2003 Data Systems & Solutions – All Rights Reserved

NAM Scenario Example (1)



The Feedwater System Engineer's homepage reflects emergent threat to FW Pumps





The FW System Engineer drills down to view pump health indicators. Recent data shows that there are two new threats to FW pump health, affecting suction pressure and flow balance.

The FW System Engineer drills down from the suction pressure indicator to see recent data from the PPC. Spikes in the graph indicate a control system problem associated with spurious closure of the Heater Drain Level Control Valve.

©2003 Data Systems & Solutions – All Rights Reserved

NAM Scenario Example (2)

FW Pump Bearings	FW Pump Suction Pressure	Flow Balance	FW Pump Flow Curve

AutoTourHost - [Condensate System SE Walkdown from 8/11/2002 09:00]

File View Review Tools Window Help

Save | Performed | Approve | Print | Notes | Filter

#	Gath		Caption	Value	Units	Min	Max	Notes	Task Instructions	Spec. Instr.	WRs	Comp	Comp	UserID	Gathered Date	PointID
1	✓	This That	P-30A motor general condition	Poor					Are there any oil leaks, blocked cooling paths,		None	CO-P-	"A" Cond	demo	8/11/2002 9:00:33 AM	COND001
2	✓	This That	P-30B motor general condition	Excelle									"B"			
3	✓	This That	P-30C motor general condition	Fair												
4	✓	This That	P-30A general condition	Poor												
5	✓	123	P-30A oil level check	24.393			8									
6	✓	This That	P-30B general condition	Good												
7	✓	123	P-30B oil level check	10.637			8		Enter oil level		None	CO-P-	B Cond	demo	8/11/2002 9:00:34 AM	COND016
8	✓	This That	P-30C general condition	Poor					Are there any obvious water leaks, obvious		None	CO-P-	"C" Cond	demo	8/11/2002 9:00:34 AM	COND006
9	✓	123	P-30C oil level check	67.618			8		Enter oil level check		None	CO-P-	"C" Cond	demo	8/11/2002 9:00:34 AM	COND018
10	✓	✓	CO-V-31 condensate pump recirc valve status	SAT					Is condensate pump recirc valve full closed,	If UNSAT, Identify reason for No	None	CO-V-	Cond Pump	demo	8/11/2002 9:00:34 AM	COND007
11	✓ c	✓	CO-V-32 condensate pump recirc valve status	SAT					Is condensate pump recirc valve full closed,	If UNSAT, Identify reason for No	None	CO-V-	Cond Pump	demo	8/11/2002 9:00:00 AM	COND008
12	✓	✓	CO-V-33 condensate pump recirc valve status	SAT					Is condensate pump recirc valve full closed,	If UNSAT, Identify reason for No	None	CO-V-	Cond Pump	demo	8/11/2002 9:00:34 AM	COND009
13	✓	✓	CO-V-14 condensate discharge valve status	SAT					What is the status of the condensate discharge	Guidance: If pump operating, it should	None	CO-V-	Cond Disch	demo	8/11/2002 9:00:34 AM	COND010
14	✓	✓	CO-V-21 condensate discharge valve status	UNSA1					What is the status of the condensate discharge	Guidance: If pump operating, it should	None	CO-V-	Cond Disch	demo	8/11/2002 9:00:34 AM	COND011
15	✓	✓	CO-V-28 condensate discharge valve status	SAT					What is the status of the condensate discharge	Guidance: If pump operating, it should	None	CO-V-	Cond Disch	demo	8/11/2002 9:00:34 AM	COND012
16	✓	✓	Status of CO-V-x1 CO-E-23A feedwater heater high level	YES					Is the CO-E-23A feedwater heater high		None	CO-V-	CO-E- High	demo	8/11/2002 9:00:34 AM	COND013
17	✓	✓	Status of CO-V-x3 CO-E-23B feedwater heater high level	YES					Is the CO-E-23B feedwater heater high		None	CO-V-	CO-E- High	demo	8/11/2002 9:00:34 AM	COND015
18	✓	✓	Status of CO-V-x5 CO-E-23C feedwater heater high level	YES					Is the CO-E-23C feedwater heater high		None	CO-V-	CO-E- High	demo	8/11/2002 9:00:34 AM	COND017

Click me to plot trend...

demo | 8/11/2002 | 9:01 AM

The FW System Engineer confirms that the Recirculation Valves are in a SAT condition. He deduces that the pressure threat is compounded by a FW Heat Exchanger tube leak because of the **RED** status of the Flow Balance component health indicator.

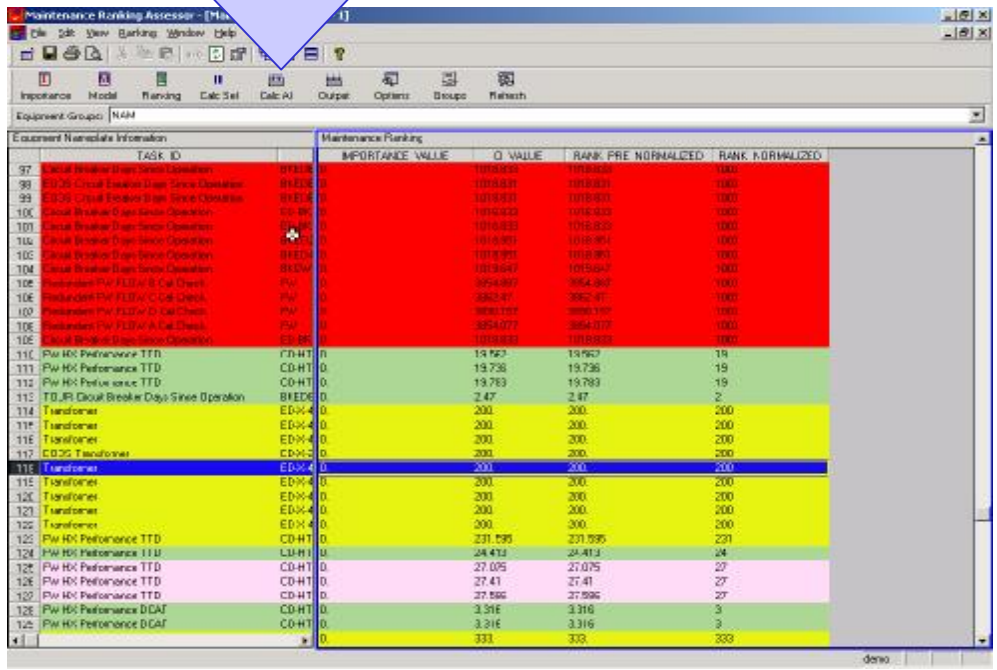
ms a Condensate
s, that the Condensate
ot leaking.

©2003 Data Systems & Solutions – All Rights Reserved

NAM Scenario Example (3)

Automated feature: MRA uses the number of suction pressure spikes to periodically update the FW Pump wear model.

Plant Monitoring System (SAIPMS)



Maintenance Ranking Assessor (MRA)

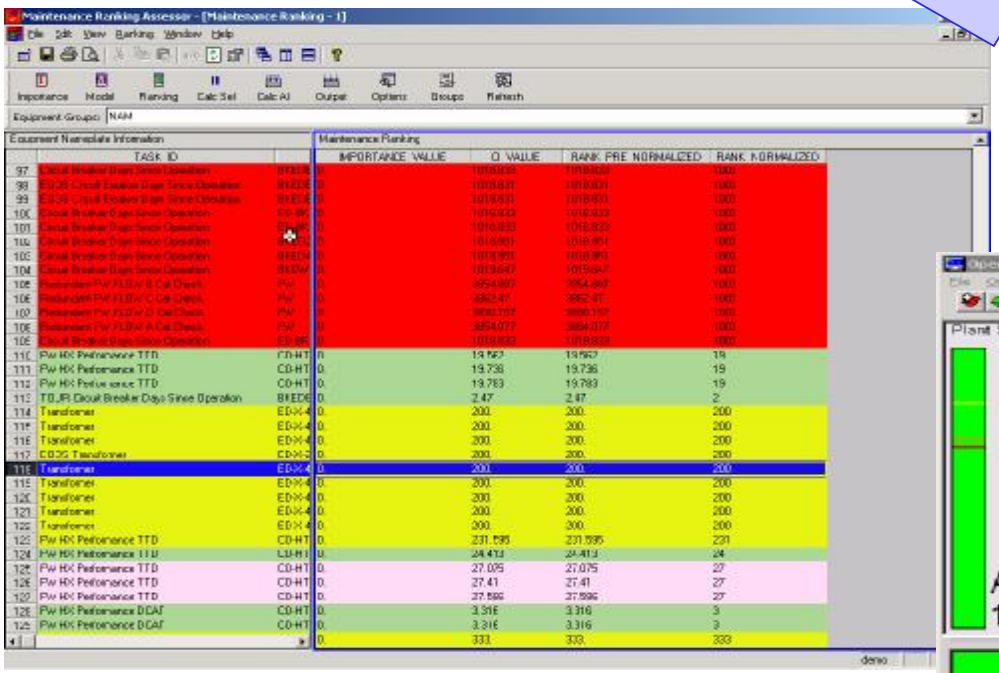
Equipment Wear Models are created in the **Maintenance Ranking Assessor (MMW)** to scale the equipment failure probability. Wear models **use real-time plant data** to determine the wear of the equipment.

©2003 Data Systems & Solutions – All Rights Reserved

NAM Scenario Example (4)

Data Systems & Solutions

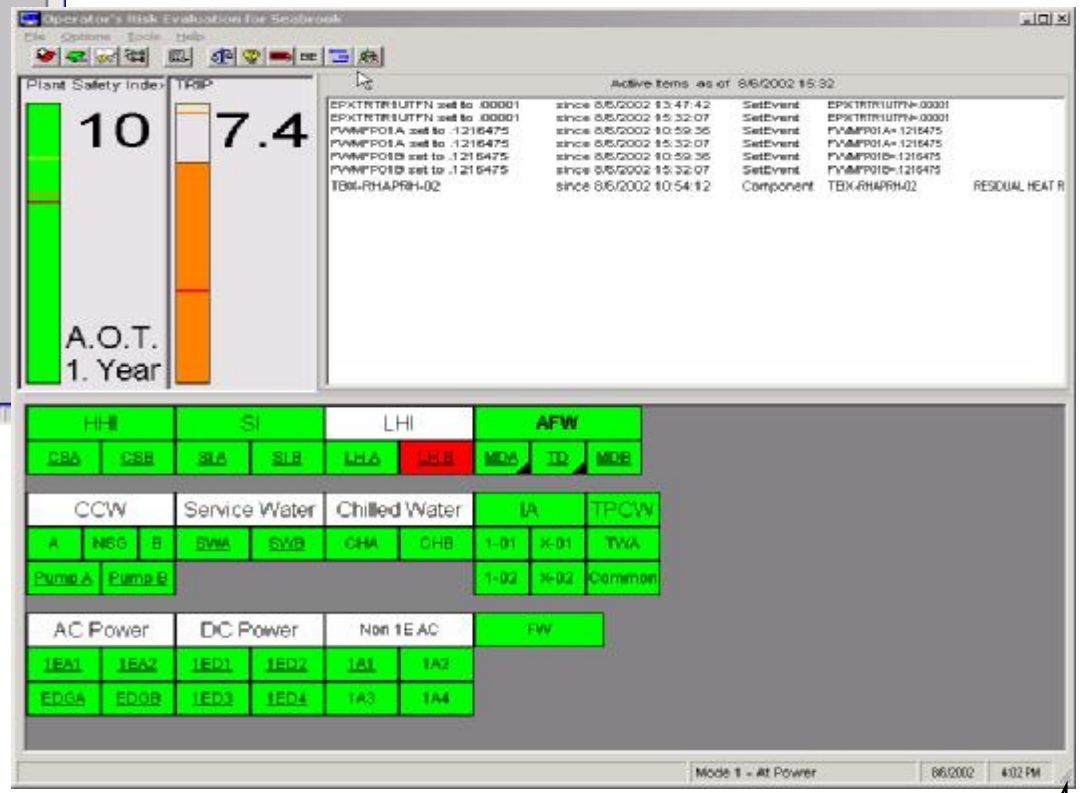
Core Enterprise



Maintenance Ranking Assessor (MRA)

Automated feature: EOOS uses the output from MRA (updated equipment wear model) to recalculate unit trip risk.

Equipment Out of Service Monitor (EOOS)



EOOS calculates the **plant risk** and **unit trip risk**, providing work planning decision support.

©2003 Data Systems & Solutions – All Rights Reserved

Data Systems & Solutions

Core Support

Systems to monitor and control equipment and ensure your plant's safety

©2003 Data Systems & Solutions – All Rights Reserved

Products & Services (1)

- Representative Services
  - Engineering (e.g., specialist I&C design, reliability, obsolescence, Safety Analysis)
  - Risk-Informed Services
    - Performance-based leak-rate testing
    - Risk-based in-service testing
    - Risk-based technical specifications
    - Graded QA
  - Plant Availability Modeling & Life Cycle Cost Modeling(LCCM) Services
  - PRA Model Building & Maintenance
  - Work Management System Implementation
  - A broad range of engineering support activities

©2003 Data Systems & Solutions – All Rights Reserved

Data Systems & Solutions

Products & Services

Core Support

- DS&S maintains a leadership position in the development of risk informed applications through close cooperation with NEI, EPRI and other industry groups.

- Recent and ongoing projects include:
  - NEI's Guidance for Risk Assessment of ILRT Interval Extensions.
  - EPRI's Spent Fuel Cask PRA Study
  - PRA model updates at Entergy (4 plants)
  - PRA Training at Brunswick
  - Level 1 PRA and EOOS implementation at Cernavoda
  - Level 1 PRA at Novovoronezh Unit 3
  - Risk Informed MOV Evaluation for British Energy Sizewell
  - Capacity factor loss model development for a US pilot utility

©2003 Data Systems & Solutions – All Rights Reserved

DS&S Industry Participation

- IAEA
  - Harmonization of VVER/RBMK PRA results
  - IPERS missions
  - PRA Software for China, Romania, Czech Republic, Slovakia
  - Risk-based Technical Specification evaluation for Dukovany and Bohunice NPPs
- Codes and Standards
  - ASME PRA Quality Standard
  - ANS Seismic and Shutdown Risk Standards
  - National Fire Protection Association (NFPA) Performance-Based Fire Protection
- Nuclear Energy Institute
  - Member
  - PRA Peer Review Certification
  - NAM Working Group Member
- International Generic Reliability Database project for WANO

©2003 Data Systems & Solutions – All Rights Reserved

Data Systems & Solutions

Summary

- **You** already have the I&C and IT infrastructure…

- …**we** have domain expertise and industry-leading products, which are the foundation for building Nuclear Asset Management tools that enhance plant ***Availability, Safety, and Financial Performance***

So

Slovakia "Pusťme sa do toho"

GO Nuclear-with confidence

©2003 Data Systems & Solutions – All Rights Reserved